Student Outcome 2
SO 2: An ability to design, implement, and evaluate software-based systems, components, or programs of varying complexity that meet desired needs, satisfy realistic constraints, and demonstrate accepted design and development principles.

Assessment Method 1: Course Data Collection

Assessment Method Description

COMP 2210 is the “CS 2” course, as described by the Association for Computing Machinery (ACM) model curricula. It is a key course required of all computing majors (CSCI, SWEN, WIRS, ECPE) at Auburn, and it appears in most all computing curricula across the country. This course requires students to design, implement, and evaluate programs that solve non-trivial computing problems. Each programming assignment is designed to require students to show competence with particular computing concepts and techniques. There are four course-specific learning outcomes (CO) that directly support the student outcome being assessed, each of which are mapped onto one or more assignments.

CO 1: An ability to implement and evaluate a program that implements searching, selection, and/or sorting algorithms on array-based collections or data structures for specific data types.

CO 2: An ability to implement and evaluate a program that implements searching, selection, and/or sorting algorithms on array-based collections or data structures for generalized/generic data types.

CO 3: An ability to implement, and evaluate a program that implements a collection using arrays and/or linked structures that meets prescribed performance requirements.

CO 4: An ability to design, implement, and evaluate a program that applies appropriate data structures, collections, and algorithms to solve a complex problem requiring various computational techniques (e.g.,
depth-first search, breadth-first search, recursive backtracking, divide-
and-conquer, greedy heuristics, randomization, etc.).

Aggregate student performance on one or more assignments that
directly address these learning outcomes is used for assessment
purposes.

### Findings

During the spring semester of 2013, five assignments from 33 CSCI
students and 37 SWEN students enrolled in COMP 2210 were used to
gather assessment data. Each assignment was aligned with a specific
course outcome, which, in turn, supported the higher-level student
outcome. The following table summarizes the assessment results.
The expectation for outcome attainment is that the average proportion of students earning B or better scores across all assignments is at least 50%. The CSCI students fell below the expected level of attainment at the aggregate level, and at the individual assignment level except for one (A6). The SWEN students met the expected level of attainment at the aggregate level, and at the individual assignment level except for one (A4).

**How did you use findings for improvement?**

Members of the CAC met and discussed these findings. Since a significant portion of the students did not meet the expected level of attainment, and since neither group of students (CSCI, SWEN) met the expected level of attainment for Assignment 4 (CO 3), the following actions were taken in COMP 2210: (1) All course materials were reviewed for appropriate topical coverage. (2) The course materials (lecture notes, lab activities, etc.) that addressed the topics associated with CO 3 were revamped and updated to make them more clear and more detailed. (3) Assignment development and submission procedures were modified to allow students to submit an assignment, get feedback on their work, make changes based on that feedback, and then resubmit. The submit-feedback-revise-submit cycle is to be used for all programming assignments in COMP 2210.
**Student Outcome 3**

SO 3: An ability to apply knowledge of computing, mathematics, science, and engineering appropriate to the discipline, particularly in the modeling and design of software systems and in the analysis of tradeoffs inherent in design decisions.

**Assessment Method 1:** Course Data Collection  
**Assessment Method Description**
COMP 2210 is the “CS 2” course, as described by the Association for Computing Machinery (ACM) model curricula. It is a key course required of all computing majors (CSCI, SWEN, WIRS, ECPE) at Auburn, and it appears in most all computing curricula across the country. This course introduces students to computing and mathematical techniques to characterize the efficiency of programs and make judgments about the relative goodness of different design decisions with respect to efficiency. The following course-specific learning outcomes (CO) directly support the student outcome being assessed.

CO 5: An ability to characterize the time complexity of a program in terms of big-oh.

CO 6: An ability to analyze efficiency tradeoffs inherent in design and implementation decisions.

Aggregate student performance on exam questions that directly address these learning outcomes is used for assessment purposes.

**Findings**

During the spring semester of 2013, the performance on relevant questions from Exam 1 for 33 CSCI students and 37 SWEN students enrolled in COMP 2210 was used to gather assessment data. Both CO 5 and CO 6 were mapped to specific questions on Exam 1, and aggregate scores on these questions were used to measure the level of attainment of these outcomes. The following table summarizes the assessment results.
The expectation for outcome attainment is that a majority of students will answer correctly at least 80% of the questions in each CO category. The CSCI students fell below the expected level of attainment at both the aggregate level and at the individual CO category level. The SWEN students met the expected level of attainment at the aggregate level, and at the CO 5 category level. SWEN students fell below the expected attainment level at the CO 6 category level.

**How did you use findings for improvement?**

Members of the CAC met and discussed these findings. Since a significant portion of the students (CSCI) did not meet the expected level of attainment at any level, and since neither group of students (CSCI, SWEN) met the expected level of attainment for CO 6, the following actions were taken in COMP 2210: (1) All course materials were reviewed for appropriate topical coverage. (2) The course materials (lecture notes, lab activities, etc.) that addressed the topics associated with CO 5 and CO 6 were revamped and updated to make them more clear and more detailed. (3) Assignments will be developed that specifically address the analysis of efficiency tradeoffs in design and implementation decisions.

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**Student Outcome 5**

SO 5: An ability to design and conduct experiments appropriate to the discipline, as well as to analyze and interpret data.

**Assessment Method 1:** Course Data Collection

**Assessment Method Description**

COMP 2210 is the “CS 2” course, as described by the Association for Computing Machinery (ACM) model curricula. It is a key course required...
of all computing majors (CSCI, SWEN, WIRS, ECPE) at Auburn, and it appears in most all computing curricula across the country. This course requires students to empirically determine the time complexity of several programs by designing and implementing experiments, collecting and analyzing data, and interpreting the results. The following course-specific learning outcome (CO) directly supports the student outcome being assessed.

CO 7: An ability to design and conduct experiments, and collect, analyze, and interpret data to determine efficiency characteristics of programs.

Aggregate student performance on one or more assignments that directly address this learning outcome is used for assessment purposes.

### Experimentation Rubric

<table>
<thead>
<tr>
<th></th>
<th>Advanced</th>
<th>Intermediate</th>
<th>Basic</th>
<th>Little/No Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Experimental Design</strong></td>
<td>The experimental procedure is well designed and allows control of all variables selected and appropriate data to be collected. All steps in the experimental procedure are documented.</td>
<td>The experimental procedure could be better designed, but it allows control of all variables selected and some appropriate data can be collected. All steps in the experimental procedure are documented.</td>
<td>The experimental procedure is not well designed, does not allow control of all variables selected, and there are concerns with the data that can be collected. Some steps in the experimental procedure are not documented.</td>
<td>There is little or no evidence of an attempt at any experimental design. There is little or no meaningful documentation of the experimental procedure.</td>
</tr>
<tr>
<td><strong>Data Collection</strong></td>
<td>The experimental procedure was carried out per the description. Appropriate data was collected. Raw data, including units, are recorded in a way that is appropriate and clear.</td>
<td>The experimental procedure was for the most part carried out per the description. Appropriate data was collected with few exceptions. Raw data, including units, are recorded although not as appropriately and clearly as they might be.</td>
<td>The experimental procedure was not carried out per the description. There are significant problems with collecting appropriate data. Raw data, including units, are not recorded in a way that is appropriate and clear.</td>
<td>There is little or no evidence of an attempt to carry out an experimental procedure. There is little or no evidence of appropriate data being collected.</td>
</tr>
<tr>
<td><strong>Data Analysis</strong></td>
<td>Data are presented in ways (charts, tables, graphs) that best facilitate understanding and interpretation.</td>
<td>Data are presented in ways (charts, tables, graphs) that can be understood and interpreted, but not as clearly as they might be.</td>
<td>Data are presented in ways (charts, tables, graphs) that are unclear.</td>
<td>There is little or no presentation of experimental data.</td>
</tr>
<tr>
<td><strong>Interpretation</strong></td>
<td>The results are appropriately interpreted and presented in a clear way.</td>
<td>The results are interpreted appropriately, but not as fully as they might be. The results are presented in a useful way, but not as clearly as they might be.</td>
<td>The results are not interpreted appropriately. The results are not presented clearly.</td>
<td>There is little or no attempt at interpreting the data. There is little or no attempt at presenting the data.</td>
</tr>
</tbody>
</table>

### Findings

During the spring semester of 2013, Assignment 3 for 26 CSCI students and 33 SWEN students enrolled in COMP 2210 was used to gather assessment data. This assignment required students to experimentally determine the time complexity of a program. The assignment was graded according to a rubric (attached). The rubric scores students’ ability along four dimensions (Experimental Design, Data Collection, Data Analysis, and Interpretation) on a scale from 1 to 4 (1-Little/No Ability, 2-Basic, 3-Intermediate, 4-Advanced). Student scores were aggregated...
for assessment purposes. The following table summarizes the assessment results.

<table>
<thead>
<tr>
<th>Performance Dimension</th>
<th>Proportion of Students Scoring At Least 80% of the Available Marks For This Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CSCI (N=26)</td>
</tr>
<tr>
<td>Experimental Design</td>
<td>65%</td>
</tr>
<tr>
<td>Data Collection</td>
<td>62%</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>31%</td>
</tr>
<tr>
<td>Interpretation</td>
<td>31%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>47%</strong></td>
</tr>
</tbody>
</table>

The expectation for outcome attainment is that a majority of students will score at least 80% of the available marks in each performance dimension. The CSCI students fell below the expected level of attainment at the aggregate level and on two of the four individual performance dimensions. The SWEN students met the expected level of attainment at the aggregate level, and three of the four individual performance dimensions.

**How did you use findings for improvement?**

Members of the CAC met and discussed these findings. The findings were generally positive, but with two clear points of weakness: data analysis and interpretation. The following actions were taken in COMP 2210: (1) All course materials were reviewed for appropriate topical coverage. (2) The course materials (lecture notes, lab activities, etc.) that addressed the topics associated with CO 7 were revamped and updated to make them more clear and more detailed. (3) Experimentation lab activities will be designed and implemented to give students more experience with empirical techniques.